The compound 2-methyl-2-(4, 8, 12-trimethyltridecyl)-6-(4-vinylbenzoyl)-chromanol can be polymerized to form (**20**) using enzyme horseradish peroxidase in the presence of hydrogen peroxide and 2,4-pentanedione using the protocols in Example 5(iii) .

What is claimed is:

1. A method for enzymatically synthesizing a functionalized polymer comprising:
coupling an antioxidant to each of a plurality of monomers; and,
enzymatically polymerizing the antioxidant-coupled monomers to form an antioxidant-coupled functionalized polymer;
whereby the resultant functionalized polymer has inherent antioxidant capabilities.

2. The method of claim 1, wherein the step of coupling an antioxidant to each of a plurality of monomers is carried out such that the resultant polymer has at least 1% of its monomeric units functionalized with antioxidants.

3. The method of claim 1, wherein the step of coupling an antioxidant to each of a plurality of monomers is carried out such that the resultant polymer has at least 10% of its monomeric units functionalized with antioxidants.

4. The method of claim 1, wherein the method further comprises coupling at least one antioxidant per monomer.

5. The method of claim 1, wherein the method further comprises selecting a monomer from the group consisting of vinylbenzoic acid, amino acids, amino acid derivatives, carbohydrates, lactones, lactides, cyclic carbonates, esters, olefins, amides, urethanes, acrylides, vinyl monomers, vinyl ethers, acetals, aryl sulfones, ether sulfones, imides, etherketones, phenylene oxides, phenylene sulfides, carbonates, epoxides, phenolics, aminoplasts, sophorolactones, nucleosides, and dendrimers.

6. The method of claim 1, wherein the step of coupling an antioxidant to each of a plurality of monomers further comprises using an enzyme.

7. The method of claim 6, wherein the step of coupling an antioxidant to each of a plurality of monomers further comprises selectively acylating primary hydroxyl groups.

8. The method of claim 6, wherein the method further comprises enzymatically coupling a primary hydroxyl group of the antioxidant to the monomer.

9. The method of claim 6, wherein the step of enzymatically coupling an antioxidant to each of a plurality of monomers further comprises selecting an enzyme from the group consisting of proteases, glycosidases, and lipases.

10. The method of claim 6, wherein the method further comprises utilizing *Candida antarctica* lipase.

11. The method of claim 1, wherein the method further comprises selecting the antioxidant from the group consisting of ascorbic acids, vitamin E derivatives, tocols, α-tocopherols, β-tocopherols, γ-tocopherols, φ-tocopherols, ε-tocopherols, ξ1-tocopherols, ξ2-tocopherols, η-tocopherols, vitamin B derivatives, thiamines, cyanocobalamins, ergocalciferols, cholecalciferols, vitamin K derivatives, phytonadiones, menaquinones, quercetins, vitamin A derivatives, retinols, retinals, 3,4-didehydroretinols, α-carotenes, β-carotenes, δ-carotenes, γ-carotenes, cryptoxanthins, citric acid, butylated hydroxyanisoles, butylated hydroxytoluenes, alpha-lipoic acids, glutathiones, carotenoids, allylic sulfides, selegilines, N-actylcysteines, lecithins, tartaric acids, caffeic acids, diaryl amines, thioethers, quinones, tannins, xanthenes, procyanidins, porphrins, phenolphthaleins, indophenol, coumarins, flavones, flavanones, and isomers, derivatives, and combinations thereof.

12. The method of claim 1, wherein the method of enzymatically polymerizing the antioxidant-coupled monomers further comprises using horseradish peroxidase (HRP).

13. The method of claim 1, wherein the method further comprises casting the polymer into a shaped form.

14. The method of claim 13, wherein the form is selected from the group consisting of films, fibers, coatings, sheets, tubes and combinations thereof.

15. The method of claim 1, wherein the method further comprises selecting a monomer that is biodegradable.

16. The method of claim 1, wherein the method further comprises selecting biodegradable monomers from the group consisting of polyesters, glycolides, lactides, trimethylene carbonates, caprolactones, dioxanone, hydroxybutyrates, hydroxyvalerates, carbonates, amino acids, "pseudo" amino acids, esteramides, anhydrides, orthoesters, sophorolactones, nucleosides, dendrimers, and combinations thereof.

17. The method of claim 1, wherein the method further comprises selecting a single type of monomer and the step of polymerizing the antioxidant-coupled monomers into an antioxidant-coupled polymer further comprises forming an antioxidant-coupled homopolymer.

18. The method of claim 1, wherein the method further comprises selecting a plurality of different monomers and the step of polymerizing the antioxidant-coupled monomers into an antioxidant-coupled polymer further comprises forming an antioxidant-coupled copolymer.

19. A method of protecting an oxygen sensitive material from degradation comprising:

coupling an antioxidant to each of a plurality of monomers;

enzymatically polymerizing the antioxidant-coupled monomers to form an antioxidant-coupled polymer; and,

surrounding the material within the antioxidant-coupled polymer,

whereby the antioxidant-coupled polymer scavenges free radicals so as to protect material from oxygen degradation.

20. The method of claim 19, wherein the step of coupling an antioxidant to each of a plurality of monomers further comprises selecting monomers from the group consisting of vinylbenzoic acid, amino acids, amino acid derivatives, carbohydrates, lactones, lactides, cyclic carbonates, esters, olefins, amides, urethanes, acrylides, vinyl monomers, vinyl ethers, acetals, aryl sulfones, ether sulfones, imides, etherketones, phenylene oxides, phenylene sulfides, carbonates, epoxides, phenolics, aminoplasts, sophorolactones, nucleosides, and dendrimers.

21. The method of claim 19, wherein the step of coupling an antioxidant to each of a plurality of monomers further comprises selecting antioxidants from the group consisting of ascorbic acid, vitamin E derivatives, tocol, α-tocopherol, β-tocopherol, γ-tocopherol, φ-tocopherol, ε-tocopherol, ξ1-tocopherol, ξ2-tocopherol, η-tocopherol, vitamin B derivatives, thiamine, cyanocobalamin, ergocalciferol, cholecalciferol, vitamin K derivatives, phytonadione, menaquinone, quercetin, vitamin A derivatives, retinol, retinal, 3,4-didehydroretinol, α-carotene, β-carotene, δ-carotene, γ-carotene, cryptoxanthin, citric acid, butylated hydroxyanisole, butylated hydroxytoluene, lecithin, tartaric acid, caffeic acid, diaryl amines, thioethers, quinones, porphrins, phenolphthalein, indophenol, coumarins, flavones, flavanones, and isomers, derivatives, and combinations thereof.

22. The method of claim 19, wherein the step of coupling an antioxidant to each of a plurality of monomers further comprises coupling ascorbic acid to the monomers.

23. The method of claim 19, wherein the step of coupling an antioxidant to each of a plurality of monomers further comprises using an enzyme.

24. The method of claim 23, wherein the method further comprises selecting the enzyme from the group consisting of proteases, glycosidases, and lipases.

25. The method of claim 23, wherein the method further comprises selectively acylating a primary hydroxyl group of the antioxidant.

26. The method of claim 23, wherein the step of enzymatically coupling an antioxidant to each of a plurality of monomers further comprises utilizing *Candida antarctica* lipase.

27. The method of claim 19, wherein the step of enzymatically polymerizing the antioxidant-coupled monomers further comprises using horseradish peroxidase (HRP).

28. The method of claim 19, wherein the method further comprises casting the antioxidant-coupled polymer into a shaped form selected from the group consisting of a film, a fiber, a coating, a sheet, and combinations thereof.

29. The method of claim 28, wherein the method further comprises housing oxygen sensitive material in direct contact with the shaped form.

30. The method of claim 19, wherein the method further comprises forming a packaging for foodstuff, wherein the antioxidant coupled polymer is in direct contact with the foodstuff.

31. The method of claim 19, wherein the method further comprises coating a pharmaceutical agent with the antioxidant coupled polymer.

32. The method of claim 19, wherein the method further comprises applying a second oxygen impermeable packaging material coating the antioxidant coupled polymer, distal to the oxygen sensitive material.

33. The method of claim 19, wherein the step of polymerizing the antioxidant-coupled monomers into an antioxidant-coupled polymer further comprises forming a homopolymer.

34. The method of claim 19, wherein the step of polymerizing the antioxidant-coupled monomers into an antioxidant-coupled polymer further comprises forming a copolymer.

35. The method of claim 19, wherein the method further comprises casting the antioxidant-coupled polymer into a conduit for oxygen sensitive material wherein the oxygen sensitive material is in direct contact with the antioxidant coupled polymer.

36. The method of claim 19, wherein the method further comprises embedding the material within the antioxidant-coupled polymer.

37. The method of claim 19, wherein the method further comprises casting the polymer around the material.

38. The method of claim 19, wherein the method further comprises utilizing biodegradable monomers.

39. The method of claim 38, wherein the method further comprises selecting biodegradable monomers from the group consisting of polyesters, glycolides, lactides, trimethylene carbonates, caprolactones, dioxanone, hydroxybutyrates, hydroxyvalerates, carbonates, amino acids, "pseudo" amino acids, esteramides, anhydrides, orthoesters, saphorolactones, nucleosides, biodegradable dendrimers, and combinations thereof.

40. The method of claim 19 or 38, wherein the method further comprises implanting the antioxidant-coupled polymer into a subject.

41. A medical device having at least one surface coated with a polymer comprising monomeric units functionalized with antioxidants, the polymer formed by coupling the antioxidants to each of a plurality of monomeric units to form antioxidant-coupled monomeric units and enzymatically polymerizing the antioxidant-coupled monomeric units,

whereby the polymer coated medical device scavenges free radicals so as to protect oxygen sensitive materials from oxygen degradation.

42. The medical device of claim 41, wherein the medical device is an implantable medical device selected from the group consisting of dialysis apparatus, stents, filtration apparatus, catheters, sutures, tubings, syringes, endoscopes, and prostheses.

43. The medical device of claim 41, wherein the antioxidant functionalized polymer coats a medical device, such that the antioxidant-coupled polymer is in direct contact with oxygen sensitive materials.

44. The medical device of claim 41, wherein the monomeric units are selected from the group consisting of vinylbenzoic acid, amino acids, amino acid derivatives, carbohydrates, lactones, lactides, cyclic carbonates, esters, olefins, amides, urethanes, acrylides, vinyl monomers, vinyl ethers, acetals, aryl sulfones, ether sulfones, imides, etherketones, phenylene oxides, phenylene sulfides, carbonates, epoxides, phenolics, aminoplasts, saphorolactones, nucleosides, dendrimers, and combinations thereof.

45. The medical device of claim 41, wherein the antioxidants are selected from the group consisting of ascorbic acid, vitamin E derivatives, tocol, α-tocopherol, β-tocopherol, γ-tocopherol, φ-tocopherol, ε-tocopherol, ξ1-tocopherol, ξ2-tocopherol, η-tocopherol, vitamin B derivatives, thiamine, cyanocobalamin, ergocalciferol, cholecalciferol, vitamin K derivatives, phytonadione, menaquinone, quercetin, vitamin A derivatives, retinol, retinal, 3,4-didehydroretinol, α-carotene, β-carotene, δ-carotene, γ-carotene, cryptoxanthin, citric acid, butylated hydroxyanisole, butylated hydroxytoluene, lecithin, tartaric acid, caffeic acid, diaryl amines, thioethers, quinones, porphrins, phenolphthalein, indophenol, coumarins, flavones, flavanones, and isomers, derivatives, and combinations thereof.

46. The medical device of claim 41, wherein a second oxygen impermeable material coats the antioxidant-coupled polymer, distal to the oxygen sensitive material.

47. The medical device of claim 41, wherein the monomeric units are biodegradable monomers.

48. The medical device of claim 47, wherein the biodegradable monomers are selected from the group consisting of polyesters, glycolides, lactides, trimethylene carbonates, caprolactones, dioxanone, hydroxybutyrates, hydroxyvalerates, carbonates, amino acids, "pseudo" amino acids, esteramides, anhydrides, orthoesters, saphorolactones, nucleosides, biodegradable dendrimers, and combinations thereof.

49. The medical device of claim 41, wherein at least 1% of its monomeric units are functionalized with antioxidants.

50. The medical device of claim 41, wherein at least 10% of its monomeric units are functionalized with antioxidants.

51. The medical device of claim 41, wherein at least one antioxidant is coupled per monomeric unit.

52. The medical device of claim 41, wherein an enzyme is used to couple an antioxidant to the monomeric units.

53. The medical device of claim 41, wherein at least one enzyme is used to polymerize the functionalized monomeric units.

54. An antioxidant coupled packaging material comprising,

a first film layer cast from a polymer with monomeric units functionalized with an antioxidant, the polymer formed by coupling the antioxidant to each of a plurality of monomeric units to form antioxidant-coupled monomeric units and enzymatically polymerizing the antioxidant-coupled monomeric units; and,

a second barrier film layer,

such that the first layer encases a material and the second layer is oxygen impermeable.

55. The antioxidant coupled packaging material of claim 54, wherein the first layer is in direct contact with oxygen sensitive materials.

56. The antioxidant coupled packaging material of claim 54, wherein the first layer has at least 1% of its monomeric units functionalized with antioxidants.

57. The antioxidant coupled packaging material of claim 54, wherein the first layer has at least 10% of its monomeric units functionalized with antioxidants.

58. The antioxidant coupled packaging material of claim 54, wherein the first layer has at least one antioxidant per monomeric unit.

59. The antioxidant coupled packaging material of claim 54, wherein the monomeric units are selected from the group consisting of vinylbenzoic acid, amino acids, amino acid derivatives, carbohydrates, lactones, lactides, cyclic carbonates, esters, olefins, amides, urethanes, acrylides, vinyl monomers, vinyl ethers, acetals, aryl sulfones, ether sulfones, imides, etherketones, phenylene oxides, phenylene sulfides, carbonates, epoxides, phenolics, aminoplasts, saphorolactones, nucleosides, dendrimers, and combinations thereof.

60. The antioxidant coupled packaging material of claim 54, wherein the antioxidants are selected from the group consisting of ascorbic acid, vitamin E derivatives, tocol, α-tocopherol, β-tocopherol, γ-tocopherol, φ-tocopherol, ε-tocopherol, ξ1-tocopherol, ξ2-tocopherol, η-tocopherol, vitamin B derivatives, thiamine, cyanocobalamin, ergocalciferol, cholecalciferol, vitamin K derivatives, phytonadione, menaquinone, quercetin, vitamin A derivatives, retinol, retinal, 3,4-didehydroretinol, α-carotene, β-carotene, δ-carotene, γ-carotene, cryptoxanthin, citric acid, butylated hydroxyanisole, butylated hydroxytoluene, lecithin, tartaric acid, caffeic acid, diaryl amines, thioethers, quinones, porphrins, phenolphthalein, indophenol, coumarins, flavones, flavanones, and isomers, derivatives, and combinations thereof.

61. The antioxidant coupled packaging material of claim 54, wherein the monomeric units are biodegradable monomers.

62. The antioxidant coupled packaging material of claim 61, wherein the biodegradable monomers are selected from the group consisting of polyesters, glycolides, lactides, trimethylene carbonates, caprolactones, dioxanone, hydroxybutyrates, hydroxyvalerates, carbonates, amino acids, "pseudo" amino acids, esteramides, anhydrides, orthoesters, saphorolactones, nucleosides, biodegradable dendrimers, and combinations thereof.

63. The antioxidant coupled packaging material of claim 54, wherein an enzyme functionalizes the monomeric units with antioxidants.

64. The antioxidant coupled packaging material of claim 63, wherein the enzyme is selected from the group comprising proteases, glycosidases, and lipases.

65. The antioxidant coupled packaging material of claim 54, wherein an enzyme polymerizes the monomeric units.

66. The antioxidant coupled packaging material of claim 65, wherein the enzyme is horseradish peroxidase (HRP).

67. A controlled delivery system for antioxidants comprising

an antioxidant bound to a biodegradable polymer composed of biodegradable monomers, the biodegradable polymer formed by coupling the antioxidant to each of a plurality of biodegradable monomers to form antioxidant-coupled biodegradable monomers and enzymatically polymerizing the antioxidant-coupled biodegradable monomers, wherein the antioxidant is present in an amount from about 20% to about 80% (w/w).

68. The controlled delivery system of claim 67, wherein the antioxidant is selected from the group consisting of ascorbic acid, vitamin E derivatives, tocol, α-tocopherol, β-tocopherol, γ-tocopherol, φ-tocopherol, ε-tocopherol, ξ1-tocopherol, ξ2-tocopherol, η-tocopherol, vitamin B derivatives, thiamine, cyanocobalamin, ergocalciferol, cholecalciferol, vitamin K derivatives, phytonadione, menaquinone, quercetin, vitamin

A derivatives, retinol, retinal, 3,4-didehydroretinol, α-carotene, β-carotene, δ-carotene, γ-carotene, cryptoxanthin, citric acid, butylated hydroxyanisole, butylated hydroxytoluene, alpha-lipoic acid, glutathione, carotenoids, allylic sulfides, selegiline, N-actylcysteine, lecithin, tartaric acid, caffeic acid, diaryl amines, thioethers, quinones, tannins, xanthenes, procyanidins, porphrins, phenolphthalein, indophenol, coumarins, flavones, flavanones, and isomers, derivatives, and combinations thereof.

69. The controlled delivery system of claim 67, wherein the antioxidant is ascorbic acid.

70. The controlled delivery system of claim 67, wherein the biodegradable monomers are natural.

71. The controlled delivery system of claim 67, wherein the biodegradable monomers are synthetic.

72. The controlled delivery system of claim 67, wherein the biodegradable monomers are selected from the group consisting of polyesters, glycolides, lactides, trimethylene carbonates, caprolactones, dioxanone, hydroxybutyrates, hydroxyvalerates, carbonates, amino acids, "pseudo" amino acids, esteramides, anhydrides, orthoesters, saphorolactones, nucleosides, biodegradable dendrimers, and combinations thereof.

73. The controlled delivery system of claim 67, wherein the antioxidant-coupled polymer is a homopolymer.

74. The controlled delivery system of claim 67, wherein the antioxidant-coupled polymer is a copolymer.

75. The controlled delivery system of claim 67, wherein the antioxidant-coupled polymer is selected from the group consisting of a film, a fiber, a coating, or combinations thereof.

76. The controlled delivery system of claim 67, wherein the antioxidant coupled polymer can be implanted into a subject.

77. The controlled delivery system of claim 67, wherein the antioxidant coupled polymer can be ingested by a subject.

78. The controlled delivery system of claim 67, wherein the antioxidant-coupled polymer comprises a topical ointment.

79. The controlled delivery system of claim 67, wherein the antioxidants are coupled to the biodegradable monomers using an enzyme.

80. The controlled delivery system of claim 79, wherein the enzyme is a lipase.

81. The controlled delivery system of claim 80, wherein the enzyme is *Candida antarctica* lipase.

82. The controlled delivery system of claim 67, wherein the biodegradable monomers are polymerized using an enzyme.

83. The controlled delivery system of claim 82, wherein the biodegradable monomers are polymerized using the enzyme horseradish peroxidase (HRP).

84. A method of controlled delivery of an antioxidant to a subject comprising

coupling an antioxidant to each of a plurality of biodegradable monomers; and

enzymatically polymerizing the antioxidant-coupled biodegradable monomers;

whereby the resultant antioxidant coupled polymer will degrade over time and deliver the antioxidant at a controlled rate to a subject.

85. The method of claim 84, wherein the method further comprises coupling at least 70% of the resultant polymer's monomer units with antioxidants.

86. The method of claim 84, wherein the method further comprises coupling at least 90% of the resultant polymer's monomer units with antioxidants.

87. The method of claim 84, wherein the method further comprises coupling at least one antioxidant per monomer.

88. The method of claim 84, wherein the method further comprises selecting the antioxidant from the group consisting of ascorbic acid, vitamin E derivatives, tocol, α-tocopherol, β-tocopherol, γ-tocopherol, φ-tocopherol, ε-tocopherol, ξ1-tocopherol, ξ2-tocopherol, η-tocopherol, vitamin B derivatives, thiamine, cyanocobalamin, ergocalciferol, cholecalciferol, vitamin K derivatives, phytonadione, menaquinone, quercetin, vitamin A derivatives, retinol, retinal, 3,4-didehydroretinol, α-carotene, β-carotene, δ-carotene, γ-carotene, cryptoxanthin, citric acid, butylated hydroxyanisole, butylated hydroxytoluene, alpha-lipoic acid, glutathione, carotenoids, allylic sulfides, selegiline, N-actylcysteine, lecithin, tartaric acid, caffeic acid, diaryl amines, thioethers, quinones, tannins, xanthenes, procyanidins, porphrins, phenolphthalein, indophenol, coumarins, flavones, flavanones, and isomers, derivatives, and combinations thereof.

89. The method of claim 84, wherein the biodegradable monomers are selected from the group consisting of polyesters, glycolides, lactides, trimethylene carbonates, caprolactones, dioxanone, hydroxybutyrates, hydroxyvalerates, carbonates, amino acids, "pseudo" amino acids, esteramides, anhydrides, orthoesters, saphorolactones, nucleosides, biodegradable dendrimers, and combinations thereof.

90. The method of claim 84, wherein the step of coupling an antioxidant to each of a plurality of biodegradable monomers further comprises utilizing an enzyme.

91. The method of claim 90, wherein the method further comprises selectively acylating a primary hydroxyl group of the antioxidant.

92. The method of claim 90, wherein the step of enzymatically coupling an antioxidant to each of a plurality of monomers further comprises utilizing a lipase.

93. The method of claim 92, wherein the step of enzymatically coupling an antioxidant to each of a plurality of monomers further comprises using the lipase *Candida antarctica* lipase.

94. The method of claim 84, wherein the step of polymerizing the antioxidant-coupled monomers further comprises using the enzyme horseradish peroxidase (HRP).

95. The method of claim 84, wherein the method further comprises casting the antioxidant-coupled polymer into a shaped form selected from the group consisting of a film, a fiber, a coating, a sheet, and combinations thereof.

96. The method of claim 84, wherein the method further comprises housing oxygen sensitive material in direct contact with the shaped form.

97. The method of claim 84, wherein the method further comprises coating a pharmaceutical agent with the antioxidant-coupled biodegradable polymer.

98. The method of claim 84, wherein the step of polymerizing the antioxidant-coupled monomers into an antioxidant-coupled polymer, further comprises forming a homopolymer.

99. The method of claim 84, wherein the step of polymerizing the antioxidant-coupled monomers into an antioxidant-coupled polymer, further comprises forming a copolymer.

100. The method of claim 84, wherein the method further comprises embedding a pharmaceutical agent within the antioxidant-coupled biodegradable polymer.

101. The method of claim 84, wherein the method further comprises casting the polymer around the material.

102. A topical ointment for controlled delivery of antioxidants comprising

an antioxidant bound to a biodegradable polymer composed of biodegradable monomers, the biodegradable polymer formed by coupling the antioxidant to each of a plurality of biodegradable monomers to form antioxidant-coupled biodegradable monomers and enzymatically polymerizing the antioxidant-coupled biodegradable monomers,

wherein the antioxidant is present in an amount from about 20% to about 80% (w/w).

103. The topical ointment of claim 102, wherein the biodegradable monomers are selected from the group consisting of polyesters, glycolides, lactides, trimethylene carbonates, caprolactones, dioxanone, hydroxybutyrates, hydroxyvalerates, carbonates, amino acids, "pseudo" amino acids, esteramides, anhydrides, orthoesters, saphorolactones, nucleosides, biodegradable dendrimers, and combinations thereof.

104. The topical ointment of claim 102, wherein the antioxidant is selected from the group consisting of ascorbic acid, vitamin E derivatives, tocol, α-tocopherol, β-tocopherol, γ-tocopherol, φ-tocopherol, ε-tocopherol, ξ1-tocopherol, ξ2-tocopherol, η-tocopherol, vitamin B derivatives, thiamine, cyanocobalamin, ergocalciferol, cholecalciferol, vitamin K derivatives, phytonadione, menaquinone, quercetin, vitamin A derivatives, retinol, retinal, 3,4-didehydroretinol, α-carotene, β-carotene, δ-carotene, γ-carotene, cryptoxanthin, citric acid, butylated hydroxyanisole, butylated hydroxytoluene, alpha-lipoic acid, glutathione, carotenoids, allylic sulfides, selegiline, N-actylcysteine, lecithin, tartaric acid, caffeic acid, diaryl amines, thioethers, quinones, tannins, xanthenes, procyanidins, porphrins, phenolphthalein, indophenol, coumarins, flavones, flavanones, and isomers, derivatives, and combinations thereof.

105. The topical ointment of claim 102, wherein the ointment further comprises a pharmaceutically acceptable excipient.

106. The topical ointment of claim 102, wherein the ointment further comprises a cosmetically acceptable excipient.

107. The topical ointment of claim 102, wherein the antioxidants are coupled to biodegradable monomers using an enzyme.

108. The topical ointment of claim 107, wherein the enzyme is a lipase.

109. The topical ointment of claim 108, wherein the enzyme is *Candida antarctica* lipase.

110. The topical ointment of claim 102, wherein at least 10% of the resultant polymer's monomeric units are functionalized with antioxidants.

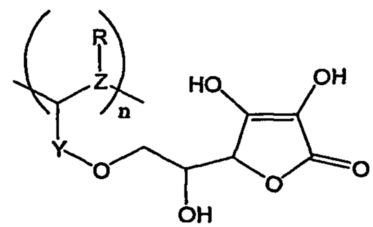
111. The topical ointment of claim 102, wherein at least 1% of the resultant polymer's monomeric units are functionalized with antioxidants.

112. The topical ointment of claim 102, wherein the topical ointment has at least one antioxidant per monomer.

113. The topical ointment of claim 102, wherein the polymer is polymerized using an enzyme.

114. The topical ointment of claim 113, wherein the polymer is polymerized using the enzyme horseradish peroxidase (HRP).

115. An ascorbyl coupled polymer with inherent antioxidant activity comprising functionalized units of formula:



wherein Y is absent, C_2H_2O, C_7H_4O or a linking group;

Z is selected from the group consisting of O, S, N, C, CH, C_6H_3, C_6H_4, C_aH_b, $C_6H_{10}O_2$, and $C_aH_bO_m$, wherein a, b, and m are integers;

R is selected from the group consisting of absent, hydrogen, oxygen, an alkyl, a hydroxy, an aryl, an aliphatic group, an aromatic group, an acyl group, an alkoxy group, an alkylene group, an alkenylene group, an alkynylene group, a hydroxycarbonylalkyl group, an anhydride, a halide, an amide, an amine, and a heterocyclic aromatic group; and

n is an integer greater than or equal to one, denoting the degree of polymerization.

116. The ascorbyl coupled polymer of claim 115, wherein at least 1% of the polymer comprises the functionalized units.

117. The ascorbyl coupled polymer of claim 115, wherein at least 10% of the polymer comprises the functionalized units.

118. The ascorbyl coupled polymer of claim 115, wherein at least 50% of the polymer comprises the functionalized units.